Proceedings of Business and Economic Studies, 2025, Volume 8, Issue 8
http://ojs.bbwpublisher.com/index.php/PBES
Online ISSN: 2209-265X
Print ISSN: 2209-2641

How Does Digitalized New Quality Productive Forces Drive Manufacturing Transformation and Upgrading?

Junjie Wu[†], Xiao Feng, Huimin Li[†]*

Guangzhou Huali College, Guangzhou, Guangdong, 511325, China
[†]These authors contributed equally to this work.

***Corresponding author:** *Huimin Li, lisiran0714@gmail.com*

Abstract: Against the backdrop of accelerated digitalization and the pursuit of high-quality manufacturing development, understanding manufacturing transformation and upgrading from the perspective of productive force restructuring has become an important theoretical issue. Focusing on Guangdong's manufacturing sector, this paper introduces the concept of digitalization-driven new quality productive forces and develops an analytical framework centered on technological efficiency improvement, factor allocation optimization, and organizational upgrading. The analysis shows that digitalization does not drive manufacturing transformation through simple technological substitution; rather, it reshapes production processes, factor allocation modes, and organizational logics, thereby fostering new quality productive forces and enabling structural and developmental transformation. At the same time, industrial differentiation, institutional heterogeneity, and uneven firm capabilities constitute key structural constraints that define the practical boundaries of this transformation and generate divergent upgrading paths across manufacturing entities. By providing a mechanism-based theoretical interpretation of the relationship between new quality productive forces and manufacturing transformation, this study offers an analytical framework for understanding regional digital manufacturing transformation and yields theoretical insights into the context-specific upgrading of Guangdong's manufacturing sector.

Keywords: Digitalized new quality productive forces; Manufacturing transformation and upgrading; Mechanism analysis; Structural constraints; Guangdong manufacturing

Online publication: December 31, 2025

1. Introduction

Manufacturing transformation and upgrading have long been regarded as a central issue in economic development, particularly in regions where manufacturing plays a dominant role in the real economy. With the rapid advancement of digital technologies such as big data, artificial intelligence, and industrial internet systems,

digitalization has become a key contextual condition shaping contemporary manufacturing development. Existing studies generally agree that digitalization has the potential to enhance productivity and promote industrial upgrading; however, how digitalization fundamentally reshapes manufacturing development remains a contested theoretical issue.

From a traditional perspective, digitalization is often treated as a form of technological input or external shock, with research focusing on its direct effects on productivity, efficiency, or industrial structure [1,2]. While this line of inquiry has generated valuable insights, it tends to emphasize outcome-oriented relationships and provides limited explanation of the deeper transformation of production systems. In practice, the diffusion of digital technologies does not automatically result in manufacturing upgrading, and significant differences can be observed across regions, industries, and firms in terms of transformation outcomes. Against this background, the concept of new quality productive forces offers a promising theoretical perspective. Rather than viewing digital technologies as isolated tools, this perspective emphasizes that under new technological conditions, productivity upgrading is driven by the restructuring of factor combinations, production organization, and development logic [3]. From this viewpoint, digitalization matters not merely because of technology adoption itself, but because it enables the formation of a new type of productive force characterized by efficiency leaps and structural transformation.

1.1. Digitalization and manufacturing transformation: Existing perspectives

A substantial body of literature has examined the relationship between digitalization and manufacturing transformation. Early studies in information economics and organizational economics point out that information technology does not automatically translate into productivity gains unless accompanied by organizational and managerial change [1]. This insight challenges technological determinism and highlights the importance of complementary organizational adjustments.

Subsequent research extends this argument by examining digital transformation at the firm and industry levels. Empirical studies suggest that digitalization can reduce information asymmetry, lower transaction costs, and improve innovation efficiency, thereby contributing to productivity growth and structural upgrading [4]. At the industrial level, digital technologies are found to facilitate the movement of manufacturing toward higher value-added segments and improve value chain positioning [5].

1.2. New quality productive forces and theoretical gaps

Recent theoretical discussions on new quality productive forces shift attention from technological inputs to the transformation of productivity structures. According to this line of research, new quality productive forces emerge through the integration of technological innovation, factor reallocation, and organizational transformation, representing a qualitative change rather than a quantitative extension of traditional productivity. This framework provides a more systematic explanation of why digitalization may lead to divergent development paths across different economic actors.

However, existing studies on new quality productive forces remain largely conceptual or macro-oriented. Although some research attempts to measure their regional distribution and development patterns, limited effort has been made to connect this concept explicitly with manufacturing transformation processes [6]. Moreover, structural and institutional constraints, such as industrial heterogeneity, factor market segmentation, and uneven firm capabilities, are often treated as background conditions rather than integral components of the analytical framework [7,8].

1.3. Research focus and contribution

Building on the above discussion, this paper integrates the perspectives of digitalization and new quality productive forces to develop a theoretical framework for understanding manufacturing transformation and upgrading. Focusing on Guangdong's manufacturing sector as an analytical context, the study emphasizes three interrelated mechanisms: technological efficiency improvement, factor allocation optimization, and organizational upgrading, to explain how digitalization-driven new quality productive forces reshape manufacturing development.

2. Theoretical analysis

Manufacturing transformation and upgrading fundamentally reflect systemic changes in productive force structures and production organization. Under conditions of digitalization, new-generation digital technologies become deeply embedded in manufacturing activities, fostering the emergence of new quality productive forces characterized by efficiency leaps and structural reconfiguration. Understanding their role requires a mechanism-based analysis grounded in productive force theory.

2.1. Formation logic of digitalized new quality productive forces

New quality productive forces do not represent a linear extension of traditional productive forces. Rather, they emerge through the restructuring of factor combinations and production relations under new technological conditions. Digitalization elevates data, algorithms, and platforms to the status of key production factors and recombines them with capital and labor, shifting production activities from experience-driven to data-driven modes. In manufacturing, this transformation not only reshapes internal production processes but also promotes system-level restructuring through platform-based and networked coordination.

2.2. Mechanism of technological efficiency improvement

Digitalized new quality productive forces influence manufacturing transformation primarily by enhancing technological efficiency. Through real-time data collection and intelligent analysis, firms reduce uncertainty and resource waste, achieving more precise control over production processes. Unlike traditional technology upgrading reliant on equipment renewal, this efficiency gain arises from changes in decision-making logic, providing internal momentum for the shift from extensive growth to high-quality development.

2.3. Mechanism of factor allocation optimization

Digitalization further promotes manufacturing transformation by optimizing factor allocation. By lowering information asymmetries and transaction costs, digital technologies enable more effective matching of capital, technology, and labor across broader scopes. Digital platforms break organizational and industrial boundaries, facilitating specialization, collaboration, and resource integration, thereby supporting the movement of manufacturing toward higher efficiency and value-added activities.

2.4. Mechanism of organizational and governance upgrading

Digitalized new quality productive forces also reshape organizational forms and governance structures. Intelligent manufacturing and platform-based production foster flatter and more networked organizational structures, enhancing coordination efficiency. Inter-firm collaboration intensifies, and industrial chains become more open and interconnected, increasing system flexibility and resilience.

2.5. Structural and institutional constraints

Importantly, digitalized new quality productive forces do not automatically translate into manufacturing transformation outcomes. Industrial heterogeneity, factor market development, institutional environments, and firm capabilities jointly shape their effectiveness. In Guangdong, significant disparities across industries and firms in absorptive capacity give rise to multiple and uneven transformation pathways.

3. Discussion

3.1. From technology adoption to productive force transformation

In policy discourse and industrial practice, digitalization is often understood primarily as the adoption or application of digital technologies by manufacturing firms. From the perspective of new quality productive forces, however, what truly carries transformative significance is not the adoption of individual technologies, but the systemic transformation of productive force structures driven by digitalization.

This distinction is particularly important in the context of Guangdong's manufacturing sector. On one hand, Guangdong possesses a highly complete industrial system and long, complex industrial chains, which makes it difficult for localized or isolated technological upgrades to generate system-wide transformation effects. On the other hand, substantial differences in technological foundations and organizational capabilities across industries and firms mean that access to digital technologies does not necessarily imply the feasibility of transformation. As a result, manufacturing upgrading cannot be adequately explained by the extent of technology adoption alone.

The analytical value of the digitalized new quality productive forces perspective lies in its ability to integrate technology, factors, and organization into a unified framework. Manufacturing transformation is thus conceptualized as a process of multi-mechanism co-evolution, rather than as a linear outcome of technological input. This perspective helps explain why, under similar digital conditions, some firms and industries achieve leapfrogging upgrades, while others remain confined to marginal efficiency improvements.

3.2. Structural constraints

Despite Guangdong's advantages in digital infrastructure and industrial scale, the translation of new quality productive forces into manufacturing transformation outcomes is subject to multiple structural constraints as follows:

(1) Pronounced internal differentiation exists within the industrial structure: High-technology manufacturing and traditional manufacturing differ significantly in terms of technological absorptive capacity, organizational flexibility, and market positioning, resulting in uneven effects of digitalized new quality productive forces;

(2) Factor market segmentation and institutional frictions weaken the efficiency of cross-regional and cross-industry factor mobility, thereby constraining the potential for factor reallocation under digitalization. These institutional barriers limit the extent to which digital technologies can facilitate optimal recombination of production factors across the manufacturing system;

(3) Small and medium-sized manufacturing firms commonly face practical constraints such as high digital investment costs, shortages of specialized talent, and elevated risks associated with organizational adjustment.

This implies that even when digitalized new quality productive forces exhibit transformation potential at an aggregate level, their effectiveness remains highly contingent on the alignment between institutional environments and firm-level capabilities.

3.3. Summary

Taken together, the discussion underscores that digitalized new quality productive forces provide a theoretical perspective that transcends a narrow "technological tool" view of manufacturing transformation. The decisive factor lies not in technology itself, but in how technology becomes embedded within existing industrial and institutional structures through efficiency enhancement, factor reconfiguration, and organizational transformation. Structural and institutional constraints, in turn, define the practical boundaries and differentiated outcomes of this process. Identifying and addressing these constraints is therefore a necessary condition for translating new quality productive forces into sustainable drivers of manufacturing transformation.

4. Conclusions and policy implications

Against the backdrop of accelerating digitalization, manufacturing transformation and upgrading can no longer be understood merely as processes of technological substitution or incremental efficiency improvement. Rather, they reflect systemic reconfigurations of productive force structures, factor allocation patterns, and organizational forms. Focusing on Guangdong's manufacturing sector, this paper adopts the perspective of digitalization-driven new quality productive forces and constructs a theoretical framework integrating mechanisms, constraints, and heterogeneity to systematically analyze how such forces shape manufacturing transformation and upgrading.

4.1. Main conclusions

Digitalized new quality productive forces offer a comprehensive theoretical framework for understanding manufacturing transformation that goes beyond a single-technology perspective. In contrast to approaches that treat digital technologies as exogenous shocks or general technological progress, this paper emphasizes that digitalization contributes to manufacturing transformation only insofar as it reshapes technological efficiency, factor allocation, and organizational forms. This conclusion helps explain the pronounced variation in transformation outcomes observed across regions, industries, and firms under digitalization.

Manufacturing transformation is not an automatic consequence of digitalized new quality productive forces. Its realization is significantly constrained by structural and institutional conditions. Industrial differentiation, factor market frictions, and disparities in firm capabilities may either weaken or amplify the transformative effects of digitalized new quality productive forces. Particularly in a region such as Guangdong, with its diverse industrial composition and heterogeneous firm population, neglecting these constraints risks overstating the overall impact of digitalization on manufacturing transformation.

Manufacturing entities exhibit substantial heterogeneity in their responses to digitalized new quality productive forces. High-technology manufacturing sectors and firms with stronger organizational capabilities are more likely to convert digital conditions into transformation advantages, whereas traditional manufacturing sectors and small and medium-sized firms face higher adjustment costs and transformation risks. This theoretical insight supports the necessity of differentiated and phased approaches to manufacturing transformation.

4.2. Policy implications

Efforts should be made at the systemic level to improve the environment for the formation of digitalized new quality productive forces. Beyond continued investment in digital infrastructure, institutional innovations are needed to reduce frictions in cross-regional and cross-industry factor mobility and to enhance the flexibility of

factor reallocation under digitalization.

Greater attention should be paid to organizational and governance transformation within manufacturing firms. Policy design should move beyond narrow emphases on technology subsidies or equipment upgrading and instead encourage complementary reforms in organizational management, production coordination, and talent structures, ensuring that digital investments are effectively embedded in firms' operational systems.

Differentiated support strategies should be implemented for different types of manufacturing entities. For firms with strong technological foundations, policies may focus on leveraging digitalization to deepen industrial chain coordination and upgrade value chain positions. For small and medium-sized manufacturing firms, targeted measures aimed at lowering digital transformation thresholds, strengthening public service platforms, and enhancing capability development are essential to prevent digitalization from exacerbating intra-industry polarization.

Funding

2023 Guangdong Provincial Education Department Youth Innovative Talent Project (Project No.: 2023WQNCX123); 2024 Provincial Undergraduate Innovation and Entrepreneurship Training Program (Project No.: S202413656204)

Disclosure statement

The authors declare no conflict of interest.

References

[1] Brynjolfsson E, Hitt L, 2000, Beyond Computation: Information Technology, Organizational Transformation and Business Performance. Journal of Economic Perspectives, 14(4): 23–48.

[2] Vial G, 2019, Understanding Digital Transformation: A Review and a Research Agenda. Journal of Strategic Information Systems, 28(2): 118–144.

[3] Ren B, 2024, The Logic of Forming New Quality Productive Forces through the Modernization of Productive Forces. Economic Research Journal, 2024(3): 12–19.

[4] Zhao C, Wang W, Li X, 2021, How does Digital Transformation Affect Firms' Total Factor Productivity? Finance & Trade Economics, 2021(7): 114–129.

[5] Dang L, Li X, Shen S, 2021, Manufacturing Digital Transformation and Export Technological Complexity Upgrading. Journal of International Trade, 2021(6): 1–15.

[6] Zeng P, Qin Y, Zhou L, 2024, Measurement and Spatiotemporal Patterns of New Quality Productive Forces in Chinese Cities. Progress in Geography, 43(6): 1102–1117.

[7] North D, 1990, Institutions, Institutional Change and Economic Performance, Cambridge University Press, Cambridge.

[8] Wang X, Hu L, Fan G, 2021, China Marketization Index Report (2021), Social Sciences Academic Press, Beijing.